

APPENDIX 19.A — TEMPORARY HYDRAULIC FACILITIES

19.A.1 INTRODUCTION

Temporary hydraulic facilities include all channels, culverts or bridges that are required for haul roads, channel relocations, culvert installations, bridge construction, temporary roads or detours. They are to be designed with the same care that is used for the primary facility.

These designs are to be included in the plans for the project. Hydraulic approval is required from the Division of Water Rights for those designs that they regulate.

Usually, the design flood frequency recommended for temporary hydraulic facilities is much lower than that used for permanent hydraulic facilities. The procedures used in determining the design flood frequency for temporary hydraulic facilities will be explained in detail in the following Section.

As for the design of highway stream crossings, temporary hydraulic facilities should be designed to accommodate floods larger than the event for which they are designed to:

- avoid undue liability for damages from excessive backwater, and
- reduce the probability of losing the temporary hydraulic facility during a larger flood.

These problems could be avoided by:

- providing a low roadway profile that allows overflow without creating excessive velocities or backwaters;
- posting warnings that the road is expected to be under water during certain rainfall events for undetermined lengths of time; and
- anchoring the temporary hydraulic facility, if needed.

19.A.2 DESIGN PROCEDURES

The selection of a design flood frequency for temporary hydraulic facilities involves consideration of several factors as discussed in Section 19.A.3. These factors are rated by the Impact Rating Values (IRV). The Total Impact Rating Value of these factors will determine the Percent Design Risk. The choice of the design flood frequency for temporary hydraulic facilities will be based on the Percent Design Risk and on the anticipated time of use in months.

19.A.3 SELECTION FACTORS

The major factors to determine the Impact Rating Value (IRV) are:

Average Daily Traffic. The average number of vehicles traveling through the area in both directions in a 24-hour period. Table 19.A-1 shows that the IRV is not only dependent on the ADT but also on the location of the highway.

TABLE 19.A-1 — Rating Selection

Factor			Impact Rating Values (IRV)		
Average Daily Traffic (ADT) (number of vehicles per day)	Urban	ADT	0-400	401-1500	> 1500
		IRV	1	2	3
	Suburban	ADT	0-750	751-1500	> 1500
		IRV	1	2	3
	Rural	ADT	0-1500	1501-3000	> 3000
		IRV	1	2	3
Loss of Life (cross-checked with roadway ADT)	Yes → IRV		15	30	45
	No → IRV		1	2	3
Property damage (cross-checked with roadway ADT)	IRV for residential, commercial, industrial areas, waste, and storm and water supply systems		10	20	30
	IRV for croplands, parking and recreational areas		5	10	15
	IRV for all others (pasture, meadow, bare soil, etc.)		1	2	3
Detour Length	Length (mi)		< 5	5-9	> 9
	IRV		1	2	3
Height above streambed	Height (ft)		< 10	10-20	> 20
	IRV		1	2	3
Drainage Area	Area (mi ²)		< 1	1-65	> 65
	IRV		1	2	3
Traffic Interruptions (see instructions)			IRV for ADT multiplied by IRV for detour length.		

Potential Loss of Life. If there is a potential loss of life caused by the destruction of the temporary drainage structure or by the roadway overtopping flood, the IRV due to this factor will be equal to the roadway ADT IRV multiplied by 15.

If there is NO potential loss of life caused by the destruction of the temporary drainage structure or by the roadway overtopping flood, the IRV due to this factor will be equal to the roadway ADT IRV only.

Property Damage. The property damage IRV caused by the destruction of the temporary drainage structure or by the roadway overtopping flood to private and public structures (houses, commercial or manufacturing); appurtenances such as sewage treatment and water supply systems; and utility structures either above or below ground is equal to the roadway ADT IRV multiplied by 10.

The property damage impact rating caused by the destruction of the temporary drainage structure or by the roadway overtopping flood to active cropland, parking lots and recreational areas is equal to the roadway ADT IRV multiplied by 5.

All other areas (pasture, meadow, bare land, etc.) shall have the same rating as the roadway ADT IRV.

Detour Length. The length in miles of an emergency detour by other roads should the temporary facility fail.

Height Above Streambed. The difference in elevation in feet between the traveled way and the bed of the waterway.

Drainage Area. The total area contributing runoff to the temporary hydraulic facility, in mi^2 .

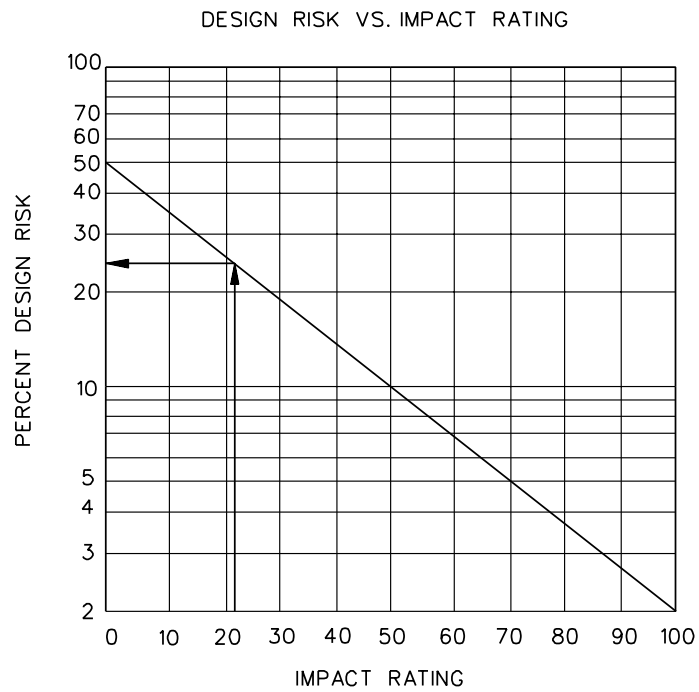
Traffic Interruption. Includes consideration for emergency supplies and rescue, delays, alternative routes, busses, etc. Short-duration flooding of a low-volume roadway might be acceptable. If the duration of flooding is long (more than one day) and there is a nearby good-quality alternative route, then the flooding of a higher volume highway might also be acceptable. The IRV of this factor is determined by the detour length IRV multiplied by the roadway ADT IRV.

Table 19.A-1 shows suggested IRV selections for each factor. The IRV for each factor is determined and entered in the Impact Rating Table (Table 19.A-2). Once the Total Impact Rating Value is determined (see Table 19.A-2), the designer then can find the Percent Design Risk from Figure 19.A-1. Figure 19.A-2 shows the recommended design frequency for the temporary hydraulic facilities based on the Percent Design Risk and on the anticipated construction time in months.

((Agency may wish to change this rating selection criteria to fit local conditions)).

TABLE 19.A-2 — Impact Rating Table

Factor	Impact Rating Value
Roadway ADT	
Loss of Life	
Property Damage	
Detour Length	
Height Above Streambed	
Drainage Area	
Traffic Interruptions	
TOTAL IMPACT RATING VALUE	

**FIGURE 19.A-1 — Design Risk versus Impact Rating**

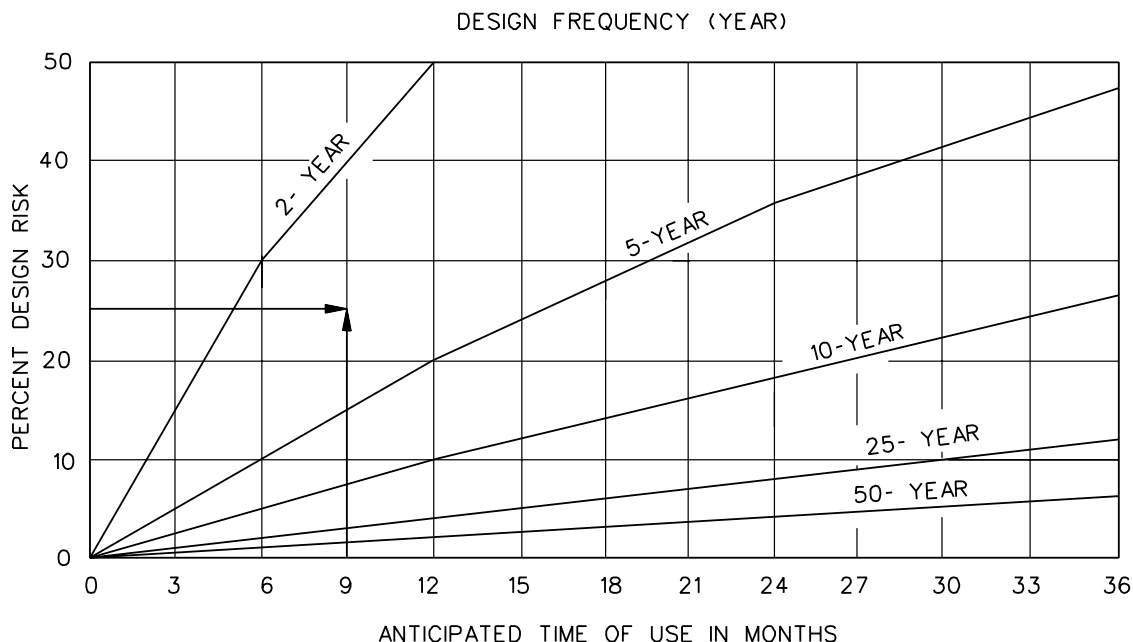


FIGURE 19.A-2 — Recommended Design Frequency

19.A.4 Example

The following Example illustrates the procedure to determine the design frequency recommended for a temporary hydraulic facility.

Given:

A section of a rural roadway will be widened. There is an existing 8 ft x 4 ft x 40 ft box culvert with a drainage area of 320 acres that must be replaced. A detour will be provided on the downstream side of the existing box. The Average Daily Traffic (ADT) of the highway is 2,000 vehicles per day (VPD). The top of the detour lane is approximately 8 ft above the streambed. The land use on the upstream side of the proposed temporary hydraulic facility is predominantly croplands. The detour length is about 6 mi. The danger of loss of life due to the destruction of the temporary hydraulic facility is minimal. The anticipated use of the detour lanes is 9 months.

Problem: Find the design frequency for the temporary hydraulic facility.

Solution:A. Compute the Impact Rating Value (IRV) based on Table 19.A-1:

- For a rural roadway with ADT of 2000 vpd, the IRV is 2.
- The IRV for no loss of life with this type of highway is 2.
- The IRV for property damage is 10 (croplands).
- For detour length equal to 6 mi, the IRV is 2.
- For height above streambed of 2.4 m, the IRV is 1.
- For drainage area = 320 ac, the IRV is 1.
- The IRV for traffic interruption is the product of the Roadway ADT IRV (2) times the Detour Length IRV (2) equals 4.

B. Total Impact Rating Value (IRV), Table 19.A-3:

The Total Impact Rating Value (IRV) is as shown in Table 19.A-3.

C. Compute the Percent Design Risk Value:

From Figure 19.A-1, for a Total Impact Rating Value = 22, the value of the Percent Design Risk is 25%.

D. Compute the Design Frequency:

From Figure 19.A-2, for a Percent Design Risk of 25% and a construction time of 9 months, the recommended design frequency for the temporary hydraulic facility is a 5-yr return period.

TABLE 19.A-3 — Impact Rating Table (Example Problem)

Factor	Impact Rating Value
Roadway ADT	2
Loss of Life	2
Property Damage	10
Detour Lengths	2
Height Above Streambed	1
Drainage Area	1
Traffic Interruptions	4
TOTAL IMPACT RATING VALUE	22